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EXAMINER

LOKE, S

ART UNIT

PAPER NUMBER

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DATE MAILED:

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UNITED STATES DEPARTMENT OF COMMERCE
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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Paper No. 16

Application Number: 09/227935
Filing Date: January 11, 1999
Appellant(s): Hasunuma et al.

Gene Z. Robinson
For Appellant

EXAMINER'S ANSWER

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This is in response to appellant's brief on appeal filed 8/2/00.

(1) *Real Party in Interest*

A statement identifying the real party in interest is contained in the brief.

(2) *Related Appeals and Interferences*

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The brief contains a statement identifying that there is no the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief. The Board, however, may exercise its discretion to require an explicit statement as to the existence of any related appeals and interferences.

(3) *Status of Claims*

The statement of the status of the claims contained in the brief is correct.

(4) *Status of Amendments After Final*

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) *Summary of Invention*

The summary of invention contained in the brief is correct.

(6) *Issues*

The appellant's statement of the issues in the brief is correct.

(7) *Grouping of Claims*

The rejection of claims 1, 2 and 4 stand or fall together because appellant's brief does not include a statement that this grouping of claims does not stand or fall together and reasons in support thereof. See 37 CFR 1.192(c)(7).

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The appellant's statement in the brief that certain claims do not stand or fall together is not agreed with because Kuroda discloses the sidewall insulating film of the connection hole is made of polycrystalline silicon (polysilicon) and silicon nitride (SiN).

(8) *Claims Appealed*

A substantially correct copy of appealed claims 1, 2 and 4 appears on page 10 of the Appendix to the appellant's brief. The minor errors are as follows: In claim 4, line 1, the phrase "side wall firm" is unclear whether it is being referred to "side wall film".

(9) *Prior Art of Record*

The following is a listing of the prior art of record relied upon in the rejection of claims under appeal.

5,825,059	KURODA	10-1998
Applicant's prior art (fig. 15)		

(10) *Grounds of Rejection*

The following ground(s) of rejection are applicable to the appealed claims:

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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Claims 1, 2 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's prior art (fig. 15) in view of Kuroda (U.S. Patent no. 5,825,059).

Prior art (fig. 15) discloses a semiconductor device. It comprises: a semiconductor substrate [1] having a main surface; an element isolating region [7] for defining an element (capacitor [200]) forming region on the main surface of the semiconductor substrate [1]; an isolation region [3] provided in a strip-shape and having a peak impurity concentration at a prescribed depth position from the main surface of the semiconductor substrate; a connection hole [10a] provided piercing through the element isolating region [7]; a TEOS oxide film [11] side wall film provided to cover a side wall of the connection hole [10a] at least near a lower end of the connection hole [10a]; an interconnection layer [13] provided to fill an inner portion of the connection hole; an impurity region [12] provided in the semiconductor substrate extending from the lower end of the connection hole [10a] to the isolation region [3], the impurity region comprises a first impurity region portion (a lower portion of the impurity region [12]) provided to connect the interconnection layer [13] to the isolation region [3], and a second impurity region portion (an upper portion of the impurity region [12]) provided near the lower end of the connection hole and connected to the interconnection layer [13].

Prior art differs from the claimed invention by not showing an anti-HF (hydrofluoric acid) side wall film.

Kuroda shows a silicon dioxide film, a silicon nitride film or a silicon oxynitride film [20] formed on the side wall of a contact hole and an impurity region [17] in fig. 5.

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Since both Prior art and Kuroda teach a contact hole of a storage electrode of a capacitor formed on an impurity region, it would have been obvious to have the silicon nitride film of Kuroda in Prior art because it protects the interconnection layer.

It is well known in the semiconductor art that silicon nitride is one of many anti-hydrofluoric acid materials.

In regards to claim 2, it is well known in the art that the silicon nitride film [20] is a nitride film.

In regards to claim 4, Kuroda further discloses a polycrystalline silicon side wall [21A] formed on the side wall of a connection hole. Kuroda shows the insulating film [20] covered with the side wall [21A] can be prevented from being damaged by hydrofluoric acid (column 6, lines 9-11).

(11) Response to Argument

In response to Appellant's argument in page 7 of the Appeal Brief, it is urged that the connection hole of Kuroda (fig. 5) does not pierce element isolation region 11. However, it is important to note that both Kuroda and prior art fig. 15 disclose a connection hole of a capacitor storage electrode (the lower electrode of a capacitor) extend through an element isolating region. Kuroda shows such element isolating region is made of a silicon dioxide insulating film [30] in fig. 5. Therefore, Kuroda does show the connection hole of a storage electrode pierce element isolation region [30].

In response to Appellant's argument in pages 5-7 of the Appeal Brief, it is urged that the examiner has not established that a person of ordinary skill in the art would have been led by a

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reading of Kuroda to consider this reference in the context of the structure of prior art Fig. 15 would have been motivated to modify the prior art Fig. 15 embodiment to result in the specifically claimed invention. In addition, it is also urged that the Office Action does not specify the manner in which the side wall structure of prior art Fig. 15 is to be modified, nor identify what disclosure in Kuroda would have impelled modification. However, applicant's written description (page 3, line 27 to page 4, line 1) of fig. 15 discloses hydrofluoric acid is being used to remove the natural oxide film formed on the p-type silicon substrate exposed at the bottom of contact hole of the bottom electrode of the capacitor. It further discloses the framing film of an oxide film such as TEOS provided on the side wall portion of contact hole is etched by the hydrofluoric acid and causing the framing film reduced in thickness, resulting in an enlarged diameter of contact hole. Kuroda also discloses a problem similar to that of applicant's prior art (fig. 15). Kuroda (column 6, lines 6-11) discloses a natural oxide film formed on the surface of the semiconductor substrate exposed at the bottom portion of the opening portion of a capacitor is removed by hydrofluoric acid. It further shows the insulating film [20] made of silicon dioxide covered with the side wall [21A] made of polycrystalline silicon can be prevented from being damaged by hydrofluoric acid. Kuroda discloses the silicon dioxide film [20] would be etched away and enlarge the diameter of the opening portion of the capacitor when an anti-hydrofluoric acid film, such as polycrystalline silicon, is not covering the silicon dioxide film [20]. Therefore, the use of a well known anti hydrofluoric acid film, such as a silicon nitride film or a polycrystalline silicon film, can be applied to the side wall of the contact hole of Prior art (fig. 15). From the above explanation, the Office

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Action does specify the manner in which the side wall structure of the prior art Fig. 15 is to be modified and identify what disclosure in Kuroda would have impelled modification. The Examiner shows the motivation to combine prior art Fig. 15 and Kuroda.

In response to Appellant's argument in pages 7-9 of the Appeal Brief, it is urged that the single impurity region of prior art Fig. 15 is not equivalent to the two impurity region portions recited in claim 1 because claim 1 discloses two impurity regions having distinct configurations which would avoid the problem of the prior art. In addition, the two impurity region portions are formed by a distinct manufacturing process which is different from the prior art. However, it is important to note that claim 1 only discloses an impurity connection means formed between the lower end of the contact hole and the isolation region. The claim never discloses the specified shape and the impurity concentration of an impurity connection means formed by the manufacturing method according to applicant's written description. Therefore, it is not necessary for the prior arts and the Office Action to disclose an impurity connection means having a structure similar applicant's written description. It is also not necessary for the prior arts to disclose an impurity connection means to overcome a significant problem with the prior art fig. 15. It is believed that the upper portion and the lower portion of the impurity regions of fig. 15 are similar to the first and second impurity regions of the claimed invention because they connected the lower end of the contact hole [10a] to the isolation region [3]. It is well known in the art that a single impurity region can be divide into multiple impurity regions.

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In response to Appellant's argument in page 9 of the Appeal Brief, it is urged that Office Action never discloses the limitation of claims 2 and 4. However, in regards to claim 2, Kuroda discloses the side wall insulating film [20] is made of silicon nitride and it is well known in the art that silicon nitride is an anti-hydrofluoric acid material. Kuroda further discloses a polycrystalline silicon side wall [21A] formed on the side wall of a connection hole. Kuroda shows the insulating film [20] covered with the side wall [21A] can be prevented from being damaged by hydrofluoric acid (column 6, lines 9-11).

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For the above reasons, it is believed that the rejections should be sustained.

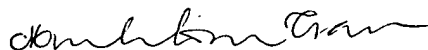
Respectfully submitted,

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October 5, 2000



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